STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

EXECUTIVE OFFICER SUMMARY REPORT
MEETING DATE: October 20, 1993

ITEM: 20

SUBJECT: BAY PROTECTION AND TOXIC CLEANUP PROGRAM - Status Report

CHRONOLOGY: Last status report February 17, 1993.

DISCUSSION: The State Board initiated the Bay Protection and Toxic Cleanup Program (BPTCP) in order to implement Sections 13390-13396 of the California Water Code (Chapter 5, Division 7). The legislation which changed the Water Code also authorized a fee structure to fund the program. The Water Code requires the State and Regional Boards to: 1) formulate, adopt and implement a water quality control plan for bays and estuaries, 2) develop and maintain a program to identify toxic hot spots, plan for their cleanup or mitigation and amend water quality control plans and policies to abate toxic hot spots, 3) develop a database that identifies and describes toxic hot spots, 4) develop ongoing monitoring and surveillance programs, 5) develop sediment quality objectives, 6) develop criteria for the assessment and ranking of toxic hot spots, 7) reevaluate waste discharge into toxic hot spots and 8) issue a 401 certification or waste discharge requirements for all dredging in toxic hot spots.

From August 1990 to May 1992 the Regional Board developed and conducted a Pilot Regional Monitoring Program (PRMP) with funds from the BPTCP. This program provided the basis for the Regional Monitoring Program now being administered by the Aquatic Habitat Institute, identified areas with toxicity and/or elevated levels of pollutants and provided information on the best ways to measure biological effects from chemical pollution. A summary of the PRMP, describing the program and some of the results was issued in December 1992 (Appendix A). A final report on bioaccumulation was issued in December 1992 and a final sediment report will be available. During 1993, Regional Board staff have initiated two study programs and completed a preliminary list of toxic hot spots.

The purpose of the first study is to identify a sediment reference site and to develop sediment Toxicity Identification Evaluation (TIE) methods for San Francisco Bay. Selection of an appropriate sediment

reference site for San Francisco Bay is necessary for comparison with other test sites. To date, most reference sites that have been chosen have exhibited toxicity that was greater than allowed in the method protocol. Sediment TIE methods will be used to determine the cause of toxicity in toxic sediment samples. Identifying the cause of toxicity will help us to determine what is causing toxicity in areas previously chosen as reference sites and will aid in the selection of appropriate remediation alternatives for polluted sites.

The second study is designed to evaluate the human health risk of consuming fish caught from San Francisco Bay. This study will measure levels of pollutants in fish caught in areas near toxic hot spots. A technical advisory committee has been formed including staff from the Regional Board, the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Health Services, the Department of Fish and Game, Save San Francisco Bay, Baykeeper, Citizens for a Better Environment and SAFER to share information, design the study and discuss results.

State Board staff is preparing a status report on the BPTCP for the legislature. Regional Board staff has prepared a preliminary list of toxic hot spots for this report. The BPTCP Task Force has developed definitions for known and potential toxic hot spots (Appendix B). These definitions are preliminary since they have not been adopted by the State Board. The strategy behind the development of the definitions was to include any areas that have any evidence of toxicity or elevated levels of pollutants on the Potential List. For the Known List there must be clear evidence of biological impact or human health risk caused by chemical pollution. Biological impact must either be clearly measured or may be assumed by recurrent exceedences of water quality objectives. This list has been compiled based on historical information and data collected in the PRMP (Appendix C). The sites on the list are not ranked in any order. Potential toxic hot spots will be monitored to determine if they should be placed on the Known Toxic Hot Spot List. Cleanup alternatives will be developed for all known toxic hot spots.

RECOMMENDATION: Information item - no action required.

File No. 1150

Appendices:
A: PRMP Executive Summary (Board Members Only)
B: Toxic Hot Spot Definitions
C: List of Toxic Hot Spots

Appendix A

APPENDIX A

EXECUTIVE SUMMARY

This report is a summary of the progress to date on the San Francisco Bay Regional Water Quality Control Board's Pilot Regional Monitoring Program (RMP). The RMP was funded by the Bay Protection and Toxic Cleanup Program. The main goal of this program was to develop a regional monitoring and surveillance program that could be used as a prototype in other bays and estuaries in the state. This was accomplished by setting up monitoring programs and special studies to evaluate various techniques and protocols used to sample water, sediment and tissue and to measure chemical contamination and toxicity. A second purpose of the program was to identify toxic hot spots in the Bay and in critical habitats (marshes, creeks and mudflats) around the Bay.

This was a multi-media program in which chemical contamination and toxicity was measured in water and sediments and bioaccumulation of contaminants was measured in tissues. The program was divided into two major monitoring programs two special study programs and a data management component. The two monitoring components were the Bay Monitoring Surveys and the Critical Habitat Investigations.

In the Bay Monitoring Surveys, chemistry and toxicity was measured in the water and sediments at stations ranging from the South Bay to the Sacramento and San Joaquin Rivers. The purposes of the Bay Monitoring Surveys were to: 1) monitor stations that in a longterm monitoring program would indicate spatial and temporal trends in toxicity and chemistry throughout the Estuary, 2) determine background for different basins in the Estuary and 3) determine if there was toxicity or high levels of contaminants at Bay stations.

Critical Habitat Investigations were conducted primarily to determine if there were high levels of contaminants or toxicity " hot spots" in the marshes, mudflats or creeks surrounding the Estuary. Toxicity was measured in the sediments. Chemical analyses was performed on sediment samples for a suite of metals and organics. Investigations of toxicity in the water column of critical habitats focused on stormwater runoff in two systems: 1) The Crandall Creek and Demonstration Urban Stormwater Treatment (DUST) marsh (DUST system) which retains stormwater in a freshwater marsh and 2) Arrowhead Marsh where stormwater is discharged into San Leandro Bay.

A special study was performed on a sediment gradient to: 1) determine which toxicity tests or type of toxicity tests (solid phase, elutriate, or pore water) could best distinguish between highly contaminated, moderately contaminated, and relatively uncontaminated sites, 2) evaluate the degree to which field replication increases the ability to distinguish between sites, 3) determine the effect of sample depth, 4) determine the relationship

between toxicity and factors that may effect toxicity including the levels of chemical contaminants, total organic carbon, grain size, ammonia and sulfides and 5) determine the relationship between toxicity test results and benthic community analysis. Shallow and deep samples were collected at stations in Castro Cove, which has been historically contaminated with effluent from an oil refinery. Five field replicates were collected at each station. Toxicity tests were performed on whole sediment, elutriates and porewater. Chemical analyses were performed on whole sediment and porewater. Samples for benthic community analysis were collected from these stations. In addition, for another program, biomarkers were measured in fish exposed to the sediment in the laboratory.

A bioaccumulation study was performed in order to: 1) describe the distribution of trace metals and organics in organisms in the San Francisco Estuary, 2) determine the differences in contaminants in organisms collected in wet and dry seasons, 3) determine the differences between mussels transplanted to shallow and deep water column depths at the same station, 4) determine the effect of depurating sediment from the guts of organisms on the contaminant levels in the whole bodies, 5) determine the optimum length of exposure for transplant organisms and 6) determine the differences in uptake in three species, each with their own salinity tolerances.

To manage the data for the entire RMP a common format was developed for all laboratories participating in the program. This allowed data to be more easily interpreted, analyzed and thoroughly checked for quality assurance. All laboratories in the program were provided with consistent formats with QA programs integrated into the data input system to insure accurate data entry. Data were generated at each of the laboratories and sent to EcoAnalysis for review.

For the sediment portion of the Bay Monitoring Surveys and Critical Habitat Investigations, stations were identified where sediment was toxic or showed elevated levels of metals or organics (see results). Sediment was monitored at 15 stations baywide during wet and dry seasons. For the Critical Habitat Investigations 32 sediment stations were monitored. Preliminary studies and data from the monitoring programs indicated that: 1) for the amphipod test Eohaustaurius estuarius seemed more sensitive than Hyalella azteca and Rhepoxinius abronius, even when a 28 day growth test was conducted with Hyalella, 2) the Menidia growth and survival test, using an elutriate, is not sensitive and should not be used in a monitoring program, 3) diver cores seemed to be the best way to collect undisturbed sediment samples, next best was the box core and 4) chemical analysis indicated that the technique used for homogenizing samples was adequate. Eohaustaurius seems to be an excellent organism for estuarine monitoring because it is tested in solid phase, is sensitive and can be tested at ambient salinity.

Only preliminary analyses have been completed on data from the gradient study but these analyses seem to indicate that: 1) toxicity was greater in deep samples, 2) this toxicity was not caused by high levels of ammonia or hydrogen sulfide, 3) toxicity tests were able to distinguish between stations, 4) field replicates were more variable than laboratory replicates, 5) three laboratory replicates may be sufficient to distinguish between stations, 6) in the bivalve larvae test, porewater samples were much more toxic than elutriate samples from the same sediment, 7) abnormality in the bivalve larvae test was highly correlated with abnormality in the sea urchin test, 8) abnormality in neither the urchin or bivalve test were correlated with the sea urchin fertilization test, and 9) sampling cores may be suitable containers for conducting amphipod tests.

For the water column portion of the Bay Monitoring surveys, monitoring of organic contaminants and toxicity was conducted at 15 and 12 stations, respectively, within the Estuary in June 1991 and April 1992. The results of the organic contaminant monitoring will be available in January 1993. Toxicity testing indicated statistically significant toxicity during the first sampling event at two stations. Each station had significant toxicity in one toxicity test. There was no significant toxicity in the second sampling event.

Investigations of toxicity in the water column of critical habitats detected toxicity in both the DUST system and Arrowhead Marsh following storm events. The DUST system was further investigated to study the fate of toxicity in the receiving waters following storm events of different intensity.

Bioaccumulation results indicated that: 1) bivalves at most of the stations within San Francisco Bay accumulated contaminant levels that were significantly higher than the controls collected at sites in more pristine locations outside of the Bay, 2) stations in the South Bay, especially Coyote Creek, were significantly higher than the Central or Northern Bay stations for DDT, PCBs, chlordane and PAHs, 3) Stations in the South and Central Bays were significantly higher than the North Bay for silver, 4) there were no significant differences in contaminant levels between wet and dry seasons, 5) there were no significant differences between mussels deployed near the surface and those deployed near the bottom, 6) a small number of metals at each station were significantly different between depurated and undepurated mussels, 7) an equilibrium appeared to be reached in mussels during the three and four month transplants for copper, mercury, lead, selenium, and chlordane, but no equilibrium was reached for silver, PCBs and possibly DDT after 120 days, 8) the patterns exhibited for DDTs, PCBs, and chlordanes for deplomen time experiments were similar indicating a similar source of these compounds and 9) oysters and mussels exhibited similar concentrations of chlordane, DDT and PCBs but PAHs differed and all metals differed greatly between the two species.

Although all of the data from the program has not been thoroughly analyzed, there are already several major accomplishments of the RMP: 1) a Baseline Monitoring Program has been established which will start in 1993, using the techniques and protocols evaluated during the RMP, to measure temporal and spatial trends in chemistry, toxicity and bioaccumulation throughout the San Francisco Estuary on an ongoing basis, 2) toxic hot spots were identified throughout the Bay and in critical habitat areas, 3) most of the marshes and mudflats in the Estuary were surveyed for chemical contamination and toxicity, 4) as the first step in setting up a statewide database, a format was generated for data and laboratories in the Bay Protection Program were trained to use these formats so that data could be easily checked for quality assurance, and integrated for statistical analysis, 5) data generated in this program can be combined with other data to generate Apparent Effects Threshold (AET) values for San Francisco Bay and 6) problems in identifying toxic hot spots and generating sediment quality criteria were identified and future studies were recommended to make the program more scientifically rigorous and provide more certainty in the final results (see Recommendations for Future Studies).

Besides the Regional Monitoring Program, studies are also underway supporting the development of a wasteload allocation for South San Francisco Bay. In the first phase, a predictive water quality model was developed based on available water quality and hydrodynamic data, using the EPA model WASP4. The second phase includes collection of time series of suspended sediment data to improve the ability to model transport of pollutants associated with sediments.

APPENDIX B

1. Known Toxic Hot Spot

A site meeting any one or more of the following conditions is considered to be a known toxic hot spot:

1. Site exceeds water or sediment quality objectives for toxic pollutants that are contained in appropriate water quality control plans.

   This finding requires chemical measurement of water or sediment, or measurement of toxicity using tests and objectives stipulated in water quality control plans. Determination of a toxic hot spot employing this finding should rely on recurrent measures over time (at least two separate sampling dates). Suitable time intervals between measurements must be determined.

2. Water or sediment exhibits toxicity associated with toxic pollutants, based on toxicity tests acceptable to the BPTCP.

   To determine whether toxicity exists, recurrent measures (at least two separate sampling dates) should demonstrate an effect. Appropriate reference and control measures must be included in the toxicity testing. The methods acceptable to and used by the BPTCP may include some toxicity test protocols not referenced in water quality control plans . Toxic pollutants should be present in the media at concentrations sufficient to cause or contribute to toxic responses in order to satisfy this condition.

3. Tissue toxic pollutant levels of organisms collected from the site exceed levels established by the Office of Environmental Health Hazard Assessment (OEHHA), California Department of Health Services (DHS), United States Food and Drug Administration (FDA) for the protection of human health, or the National Academy of Sciences (NAS) for the protection of human health or wildlife; or a health warning against the consumption of such organisms has been issued by OEHHA or DHS.

Acceptable tissue concentrations are measured either as muscle tissue (preferred) or whole body residues. Residues in liver tissue alone are not considered a suitable measure for known toxic hot spot designation. Animals can either be deployed (if a resident species) or collected from resident populations. Recurrent measurements are required. Residue levels established for the protection of human health can be applied to any consumable species.

Shellfish: Except for existing information, each sampling episode should include a minimum of three replicates and the value of interest is the average value of the replicates. Each replicate should be comprised of at least 15 individuals. For existing State Mussel Watch information related to organic pollutants, a single composite (20-100 individuals) sample may be used instead of the replicate measures. When recurrent measurements exceed one of the levels referred to above, the site is considered a known toxic hot spot.

Fin-fish: A minimum of three replicates is necessary. The number of individuals needed will depend on the size and availability of the animals collected; however, a minimum of five animals per replicate is recommended. The value of interest is the average of the three replicates. Animals of similar age and reproductive state should be used.

4. Impairment is associated with toxic pollutants found in resident individuals.

Impairment means reduction in growth, reduction in reproductive capacity, abnormal development, histopathological abnormalities, or identification of adverse effects using biomarkers. Each of these measures must be made in comparison to a reference condition (the endpoint measured in the same species and tissue collected from an unpolluted site reference site).

Growth Measures: Reductions in growth can be addressed using suitable bioassays acceptable to the BPTCP or through measurements of field populations.

Reproductive Measures: Reproductive measures must clearly indicate reductions in viability of eggs or offspring, or reductions in fecundity. Suitable measures include: pollutant concentrations in tissue, sediment, or water which have been demonstrated in laboratory tests to cause reproductive impairment; significant differences in viability or development of eggs between reference and test sites.

Abnormal Development: Abnormal development can be determined using measures of physical or behavioral disorders or aberrations. Indications that the disorder can be caused by toxic pollutants, in whole or in part, must be available.

Histopathology: Abnormalities representing distinct adverse effects, such as carcinomas or tissue necrosis, must be evident. Indications that toxic pollutants are capable of causing or contributing to the disease condition must also be available.

Biomarkers: Direct measures of physiological disruption or biochemical measures representing adverse effects, such as significant DNA strand breakage or perturbation of hormonal balance, must be evident. Biochemical measures of exposure to pollutants, such as induction of stress enzymes, are not by themselves suitable for determination of known toxic hot spots. Indications that a toxic pollutant causes or contributes to the adverse effect are needed.

5. Significant degradation in biological populations and/or communities associated with the presence of elevated levels of toxic pollutants.

This condition requires a demonstration that diminished numbers of species or changes in the number of individuals of a single species (when compared to a reference site) are associated with concentrations of toxic pollutants. The analysis should rely on measurements from multiple stations. Care should be taken to ensure that at least one site is not degraded so that a suitable comparison can be made.

In summary sites are designated as known hot spots after generating information which satisfies any one of the five conditions of the working definition. To utilize this working definition, a list of toxicity tests has been assembled. This list identifies toxicity tests that can be employed in monitoring and surveillance activities described in regional monitoring plans and partially satisfies the Water Code requirement [Section 13392.5(a)(2)] for standardized analytical methods (Department of Fish and Game, 1993). The BPTCP toxicity methods are listed in Table 8 in Chapter IV.

2. Potential Toxic Hot Spot

In addition to the identification of known toxic hot spots, the statute requires the identification of suspected or potential hot spots (Water Code Section 13392.5). Sites with existing information indicating a possibility of impairment but without sufficient information to allow a finding consistent with the working definition of a known toxic hot spot are classified as potential hot spots. More specifically, four conditions sufficient to identify a potential toxic hot spot have been determined. If any one of these conditions is satisfied, a site can be designated a potential toxic hot spot. These are:

1. Concentrations of toxic pollutants are elevated above background levels but insufficient data are available on the impacts associated with such pollutant levels to determine the existence of a known toxic hot spot;

2. Water or sediments containing toxic pollutants exhibit toxicity in screening tests or tests other than those used by the BPTCP;

3. Tissue toxic pollutant levels in resident or test species are elevated but do not meet conditions for determination of the site as a known hot spot; tissue toxic pollutant levels exceed maximum tissue residue levels (MTRLs) derived from water quality objectives contained in appropriate water quality control plans; or a health warning has been issued for the site by a local public health agency; and/or

4. The level of pollutant at a site exceeds Clean Water Act Section 304(a) criterion, or sediment quality guidelines or EPA sediment toxicity criteria for toxic pollutants.

Appendix C

APPENDIX C

REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
PRELIMINARY LIST OF KNOWN TOXIC HOTSPOTS
October 7, 1993

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-5)	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER *	GENERAL COMMENTS
Central SF Bay	Oakland Inner Harbor	Multiple Sites	K2	Ag, Cd, Cr, Cu, Hg, Pb, DDTs, PAHs, PCBs, TBT Chlordane, Dieldren	10 - 50	2, 3, 4, 5, 18, 21, 23, 40, 62	
Central SF Bay	Richmond Harbor	Lauritzen Canal	K3	DDT, Dieldrin, Aldrin, Endrin, Hg, Zn	10 - 50	7, 23, 26, 30, 59, 65-67	YES - 1
San Pablo Bay	Castro Cove	Multiple Sites	K2	PAH's, Cu, Hg, Ni	50 - 250	21, 23, 69	
Lower SF Bay	Hunters Point	Multiple Sites	K2	Ag, Cr, Cu, Hg, Pb, Zn, PCBs, TBT	10 - 50	1, 23, 25, 70, 103	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-5)	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER *	GENERAL COMMENTS
South SF Bay	South Bay (South of Dumbarton Bridge)	Multiple Sites in South Bay including South Bay Basin, Coyote Creek, Artesian Slough, Guadalupe Slough, Mowry Slough and off Palo Alto Outfall	K1	Cu, Hg, Ni	>250	7, 21, 25, 29-32, 40, 71-73, 108	YES - 2
Lower San Francisco Bay	Between Dumbarton and Bay Bridge	Multiple Stations including Dumbarton Bridge - RMP[1] BA30 and Redwood Creek - RMP BA40	K1	Cu	>250	25, 80, 81, 82	YES - 3

1. RMP - San Francisco Bay Regional Monitoring Program Station

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-5)	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER *	GENERAL COMMENTS
San Pablo Bay	Between Richmond Bridge and Carquinez Bridge	Multiple Stations including Miller Creek	K1	Cu	>250	25, 80, 81, 82	YES - 3
Carquinez Strait/Suisun Bay	Between Carquinez Bridge and Chipps Island	Multiple Stations including Honker Bay, Peyton Slough, Boynton Slough, Peytonia Slough and Chadbourne Slough	K1	Cu	>250	25, 80, 81, 82	YES - 3
San Francisco Bay + Delta	San Francisco Bay + Delta	See Comments	K3	Hg	>250	60	YES - 4
Suisun Bay	Suisun Bay	See Comments	K3	Se	>250	61	YES - 5

Comments:

* For the Known List, only data that were used to designate these areas as Known Toxic Hotspots are cited. Studies for maintenance dredging, where the material was dredged, were not used. In addition, data gathered before 1985 were not used, except in situations where health warnings are still in effect. For the Potential List, data gathered before 1985 and dredging data were used when they were the only data available or when they provided relevent information on the site.

1. Organisms from the Lauritzen Canal have exceeded FDA action levels and MTRL's for DDT and dieldrin.
2. Exceeds water quality objective for Cu, Hg and Ni.
3. Exceeds water quality objectives for Cu.
4. Health warning for striped bass which is a migratory species. This warning is presently being reevaluated.
5. Health warning for Diving Ducks; Scaups + Scoters.

REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
PRELIMINARY LIST OF POTENTIAL TOXIC HOTSPOTS
October 7, 1993

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Central SF Bay	Islais Creek	Above 3rd Street Bridge	P1, P2	Ag, As, Cr, Hg, Pb, PAHs, PCBs	10-50	23, 49	
South S.F. Bay	Redwood Creek	Multiple Sites	P1, P2	Ag, Cr, Cu, Hg, Ni, Pb, Se, TBT	50 - 250	21, 23, 25, 27, 29, 40, 68, 75, 84	
Central S.F. Bay	Oakland Outer Harbor	Multiple Sites	P1, P2	Ag, Cr, Cu, Hg, Pb, TBT	10 - 50	2, 3, 18, 62, 64	
Carquinez Strait	Mare Island Strait	RMP BD51 & BD52	P2	Ag, Cd, Cr, Hg, Pb	10 - 50	2, 21	
Central S.F. Bay	China Basin	Multiple Sites	P1, P2	Ag, Cd, Cr, Cu, Hg, Pb, PAH, PCB	<10	2, 76, 98	
Central S.F. Bay	Warmwater Cove (S. of Potrero Pt.)	Multiple Sites	P1	Cr, Ni, Pb, Zn, PAHs	<10	76, 105	
Central S.F. Bay	Alcatraz Disposal Site	Multiple Sites	P2	See Comments	50 - 250	6, 8, 12, 14, 17, 19, 20, 22, 28, 33, 37, 42, 48, 50, 58, 63, 74, 79, 85-98	YES - 1

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Central S.F. Bay	Treasure Island	Multiple Sites	P2	Cd, Cr, Hg, DDT, PAH, PCB	<10	1, 3, 23	YES - 2
Suisun Bay	Concord Naval Weapons Station	Middle Point Marsh, Port Chicago Reach	P1	As, Cd, Hg, Ni, Pb, Se, Zn	50 - 250	45, 46	
Lower S.F. Bay	Alameda NAS	Multiple Stations	P2	Ag, As	<10	1, 40, 49	
South S.F. Bay	Guadalupe Slough	Multiple Stations	P1, P2	Ag, Cr, Hg, Ni	<10	2, 12, 71, 95, 105, 106, 108, 109	
South S.F. Bay	Moffett Channel	C-1-1	P1	Ag, Cr, Hg, Ni, Se		108	
South S.F. Bay	Artesian Slough	C-2-5	P1, P2	Ag, Cr, Cu, Hg, Ni, Se, Zn	<10	72, 108, 110	
South S.F. Bay	Mowry Slough	R-2, R-4, R-5	P1, P2	Ag, Cr, Hg, Ni	<10	72, 108, 109, 110	
South S.F. Bay	Coyote Creek	RMP Station BA10, C-3-0, C-6-0, C-X	P1, P2	Ag, Cr, Hg, Ni, PAHs,PCBs, DDTs, Chlordane	<10	32, 72, 108, 110	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
South S.F. Bay	Mayfield Slough (includes Palo Alto discharge channel)	Station 2, 3 & 4	P1, P2	Ag, Cr, Cu, Ni	<10	31, 71, 107	
South S.F. Bay	South Bay Basin	SB-5, SB-6, SB-7 & RMP Station BA20	P1, P2	Ag, Cr, Hg, Ni	<10	72, 108, 109,110	
Lower S.F. Bay	Dumbarton Bridge	SB4, RMP Station BA30, NOAA Station, Mussel Watch Station	P2	Cr, Cu, Hg, Ni	<10	13, 15, 21, 23, 31, 32, 71, 72, 107, 108	
Carquinez Straits	Selby	Multiple Stations	P1	Cr, Pb, Zn	<10	23, 43, 44, 47, 84	YES - 3
Suisun Bay	Suisun Slough	Section 1 & 2	P2		<10	77	
Carquinez Straits	Peyton Slough	Multiple Stations	P1, P2	As, Cd, Cr, Cu, Ni, Zn, TPH	<10	21, 51-57	
Lower S.F. Bay	San Bruno Shoals	RMP Station 4SBS, NOAA Station	P1, P2	Cu*	<10	25, 40	
Central S.F. Bay	San Leandro Bay	Multiple Sites	P2	Cr, Hg, Pb, Zn	10 - 50	2, 21, 34, 35	
San Pablo Bay	Point Molate	Fuel Pier	P2	TPH	<10	17	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Carquinez Strait	Carquinez Disposal Site	Multiple Sites	P2	See Comments	<10	9, 16, 77, 99 - 102	YES - 1
Gallinas Creek (Tributary to San Pablo Bay)	Gallinas Creek	RMP MD2	P2	Cr, Cu, Pb	<10	2, 21	
San Pablo Bay	San Pablo Bay Reference Site	NOAA Station	P2		<10	2, 3, 40, 49, 109, 110	
Suisun Bay	Grizzly Bay	RMP BF20	P2		<10	21	
Central S.F. Bay	India Basin	Multiple Sites	P1	PAHs, PCBs	50 - 250	2	
Suisun Bay	Boynton Slough	RMP MF10, MF11, MF12	P2		<10	21	
Central S.F. Bay	Port of Richmond (Point Potrero, Pasha)	Long Wharf #3, West Inlet	P1	PCB's, PAH's, Cu, Hg, Pb, Zn	<10	38, 61	
Carquinez Strait	Semple Point, Off Vallejo	NOAA Station VA7	P1	Cr, Hg	<10	3	
Central S.F. Bay	Oakland Middle Harbor	IC2	P2	Cr, Hg	10 - 50	64	
Richardson Bay	Sausalito Harbor	RMP BC30 + Other sites	P1, P2	Cu, Hg, TBT	<10	21, 75, 78	
Central S.F. Bay	Off Staufer	RMP BC50	P2		<10	21, 23	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Carquinez Strait	Pacheco Creek	RMP BF10	P2		<10	21	
Suisun Bay	Hill Slough	RMP MF20, MF21	P2		<10	21	
Central S.F. Bay	Emeryville Marsh	EBMUD Storm Drain - RMP MC30	P2	Pb, Zn	<10	21	
Central S.F. Bay	Corte Madera Marsh	RMP MC50	P2		<10	21	
Central S.F. Bay	Hoffman Marsh	Multiple Stations	P1	Ni, PCBs	<10	36	
Novato Creek	Novato Creek (Tributary to San Pablo Bay)	At Lock - RMP MD21	P2		<10	21	
San Pablo Bay	Tolay Creek Mouth	RMP MD31	P2		<10	21	
San Pablo Bay	Napa Slough	RMP MD32 At Bridge	P2		<10	21	
San Pablo Bay	Sonoma Creek	At Tubbs - RMP MD33, At Bridge - RMP MD34	P2		<10	21	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Richardson Bay	Silva Island Marsh	At Seminary Dr. Storm Drain - RMP MC61	P2	Pb	<10	21	
Miller Creek	Miller Creek (Tributary to San Pablo Bay)	Las Gallinas Discharge - RMP MD10, Upstream from discharge - RMP MD11	P2		<10	21	
San Pablo Bay	Richmond Rod and Gun Club	Multiple Sites	P1	Pb	<10	22	
Lake Merritt	Lake Merritt	Mussel Watch Station	P1	Chlordane, PCB, PAH, DDT	10 - 50	23	
Suisun Bay	Chadbourne Slough	RMP MF13	P2		<10	21	
Lower Bay	Off SFO Airport	NOAA Station	P2		<10	40	
Lower Bay	Off Coyote Point	NOAA Station	P2		<10	40	
Lower Bay	Off San Lorenzo	NOAA Station	P2		<10	40	
Bolinas Lagoon	Bolinas Lagoon	North Shore	P2		<10	24	

WATERBODY NAME	WATERBODY SEGMENT NAME	SPECIFIC LOCATION (SITE)	TRIGGER NUMBER (1-4) **	POLLUTANT(S) INVOLVED	AREAL SIZE ESTIMATE FOR *THS* (ACRES)	DATA CITATION NUMBER	GENERAL COMMENTS
Lower SF Bay	Oyster Point/ Sierra Point	Multiple sites including RMP Station BB30 + BB31	P1,P2	PAHs, Ni*	<10	21, 25, 84	
San Pablo Bay	Petaluma River Mouth	RMP Station BD20	P2		<10	21	
Lower San Francisco Bay	Hayward Marsh	Multiple Stations	P2		<10	83	
San Pablo Bay	Davis Point	RMP Station BD40	P1	Ag	<10	21	
Lower Bay	Off San Leandro	NOAA Station	P2		<10	40	

Comments:

* Exceeded water quality objective once.

** Chemicals listed may have been measured at a different time, station or in a different media than toxicity tests and, therefore, may not be related. This is true for sites with both a P1 and P2 trigger. Sites with a P2 trigger and chemicals listed had chemical concentrations elevated above background, but not as high as those given a P1, P2.

1. These sites are constantly changing due to dredge disposal activities.
2. Reference #3 calls this site Yerba Buena Island.
3. Cleanup has occurred, but may not be complete.

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